Flexible Resource Adequacy Criteria and Must-Offer Obligation – Phase 2

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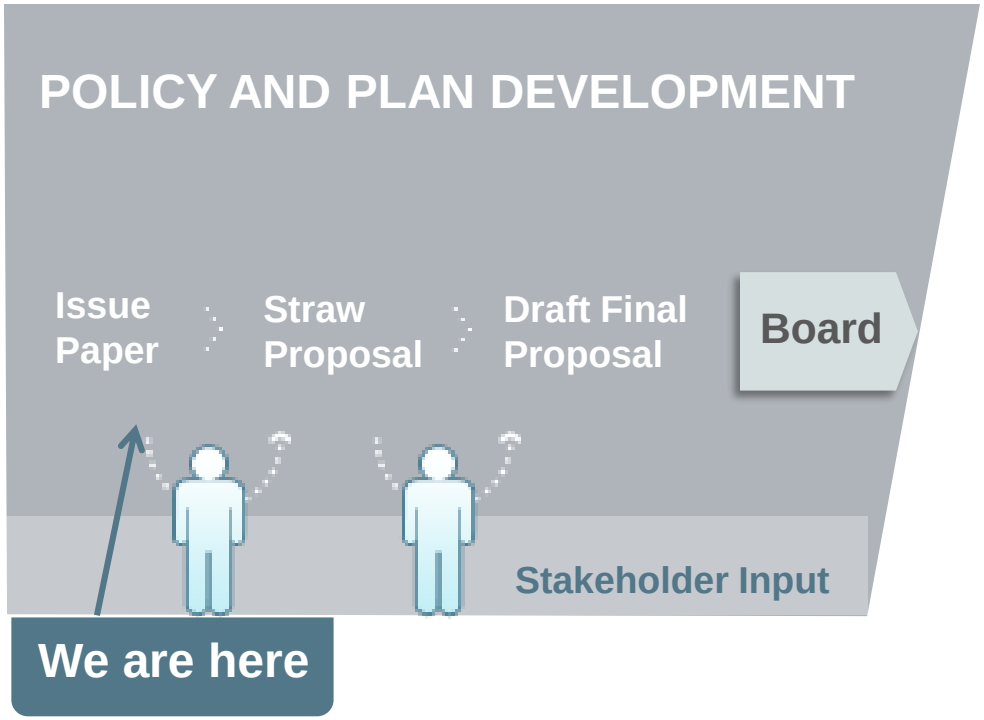
Market Design and Regulatory Policy Lead

Working Group Meeting
August 18, 2015

FRACMOO 2 Working Group Meeting Agenda – 8/18/15

Time	Topic	Presenter
10:00 – 10:10	Introduction	Tom Cuccia
10:10 – 10:20	Summary of stakeholder comments	Lauren Carr and Naor Deleanu
10:20 – 11:30	Defining the over-generation	Karl Meeusen
11:30 – 12:00	Discussion: ISO levers and over-generation	
12:00 – 1:00	Lunch	
1:00 – 2:00	Discussion: RA options and inflexible capacity RA "allowances"	Karl Meeusen
2:00 – 2:30	SCE's Durable Flex RA Proposal	Martin Blagaich
2:30 – 2:45	Break	
2:45 – 3:30	SCE's Durable Flex RA Proposal (cont.)	Martin Blagaich
3:30 – 3:50	Recap	Karl Meeusen
3:50 – 4:00	Next Steps	Tom Cuccia

ISO Policy Initiative Stakeholder Process



FRACMOO2 scope and stakeholder process

- Scope
  - Defining the flexible capacity requirements and developing any additional flexible capacity needs
  - Provision of flexible capacity by intertie resources, including Effective Flexible Capacity calculation
  - Flexible capacity from storage resources not using the NGR model
  - Flexible capacity impacts of uncontracted/merchant VERs, for which no LSE has associated flexible capacity requirements
- Working group process
  - Three working group meetings
  - The first meeting: July 22, 2015
  - Concludes by end of September 2015
- Stakeholder process
  - Straw Proposal issued: October 2015
  - Straw Proposal will
    - Start the regular ISO stakeholder process for FRACMOO2; and
    - provide the CPUC with a proposal to consider in the RA proceeding
- Board of Governors
  - Q2, 2016

Objectives of FRACMOO2 Working Group and Stakeholder initiative

- Clearly define over-generation and the ISO's concerns
- Create efficient linkage between RA and energy markets to ensure the ISO is able to address
  - Gross load plus required reserves
  - Net load and ramp rates
  - Potential over-generation through responsible forward planning
- Develop a proposal for CPUC consideration to establish any planning/procurement targets to address over-generation post-2017
- Provide LSEs and LRAs opportunity to find least cost means of addressing system, local, and flexible capacity needs

Summary of stakeholder comments

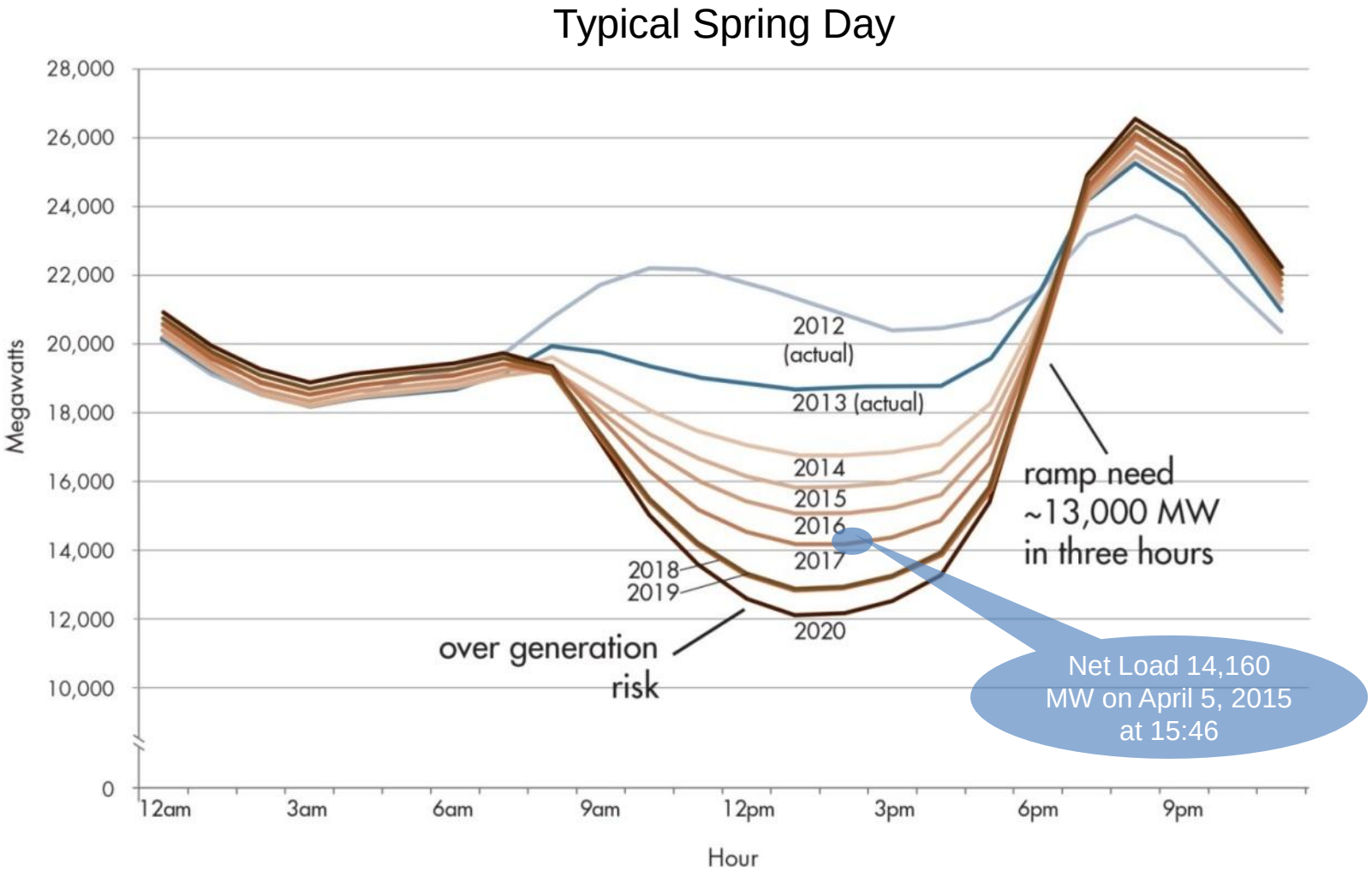
- No clear demonstration of need
  - Uncertain cost/benefit (Six Cities, CPUC, PG&E)
- Necessary tools already exist
  - Not clear how existing product is working or won't also address over-generation (Calpine, CPUC, CLECA, LSA, ORA, PG&E, NCPA, SDG&E)
  - Lower bid floor or exports may would solve the problems (Six Cities, SDG&E, PG&E)
- No need for a capacity product, rely on market (and occasional out-of-market) solutions
  - Prices, curtailments, and/or operating procedures will solve (LSA, CLECA, NCPA, ORA, Six Cities, SDG&E, WPTF)

Summary of stakeholder comments

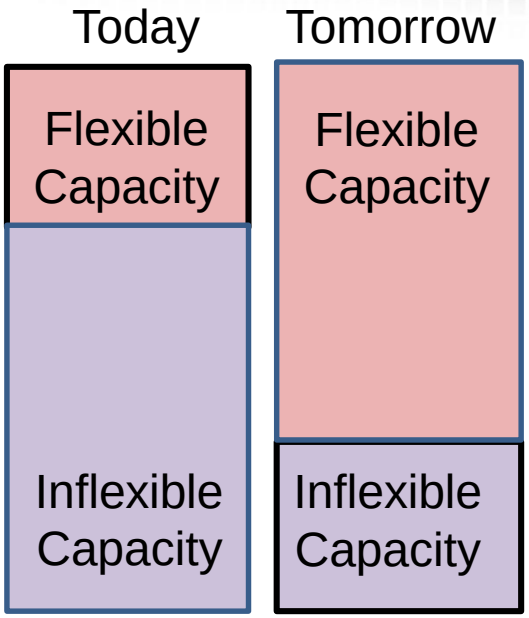
- Determination of inflexible/flexible capacity needs requires more details (PG&E, SDG&E, ORA, LSA, NCPA, WPTF, CLECA)
  - Treatment of Pmin may exacerbate over-generation (Calpine, NCPA, WPTF)
  - Limit inflexibility in all months (Wellhead, WPTF, Calpine)
- Allowances are overly complicated and/or need additional explanation (CLECA, CDWR, CESA, Wellhead, LS Power, Six Cities)
- Options for addressing self-scheduling
  - Lower the bid floor (SDG&E, PG&E, NCPA, Six Cities)
  - Push negative prices to DA (SDG&E)

DEFINING OVER-GENERATION

Original estimate of net-load as more renewables are integrated into the grid



Outlook



- The energy sector is transforming
- Driving forces:
  - State and national environmental goals
  - Technological expansion
    - More diverse resources
    - Cost reductions
  - Expanded interaction between transmission and distribution level resource
- Question to date: How much flexible capacity is needed?

The paradigm is shifting

- It is time to change the question: Is there a need to limit the quantity of inflexible capacity?

Defining over-generation*

- Over-generation – When energy supply exceeds the system's ability to absorb that supply while maintaining
  - Sufficient upward ramping capability to address upcoming net load ramps
  - Regulation
  - Contingency reserves
- An RA portfolio with sufficient upward ramping speed should also possess sufficient downward ramping speed to meet ISO needs

* Over-generation and downward flexible capacity needs are used synonymously

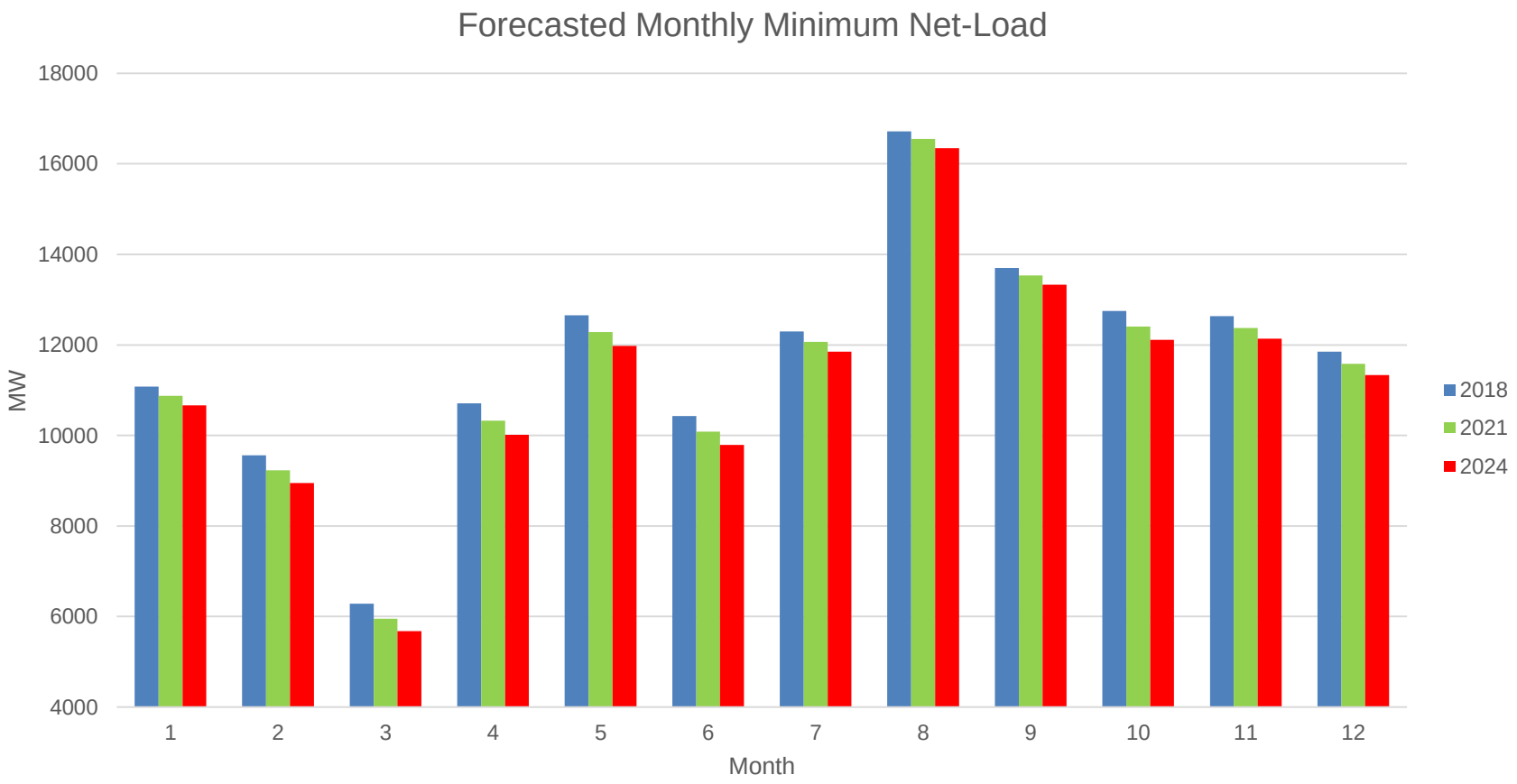
Average LMPs in February 2016

- 10.6 percent of all trade intervals between 6-20 showed average system LMP less than $0
  - 0.4 percent at the bid floor
  - 7.92 percent of all trade intervals showed system wide LMP less than $0
  - 12.6 percent of all trade intervals between 6-20 showed average system LMP less than $1

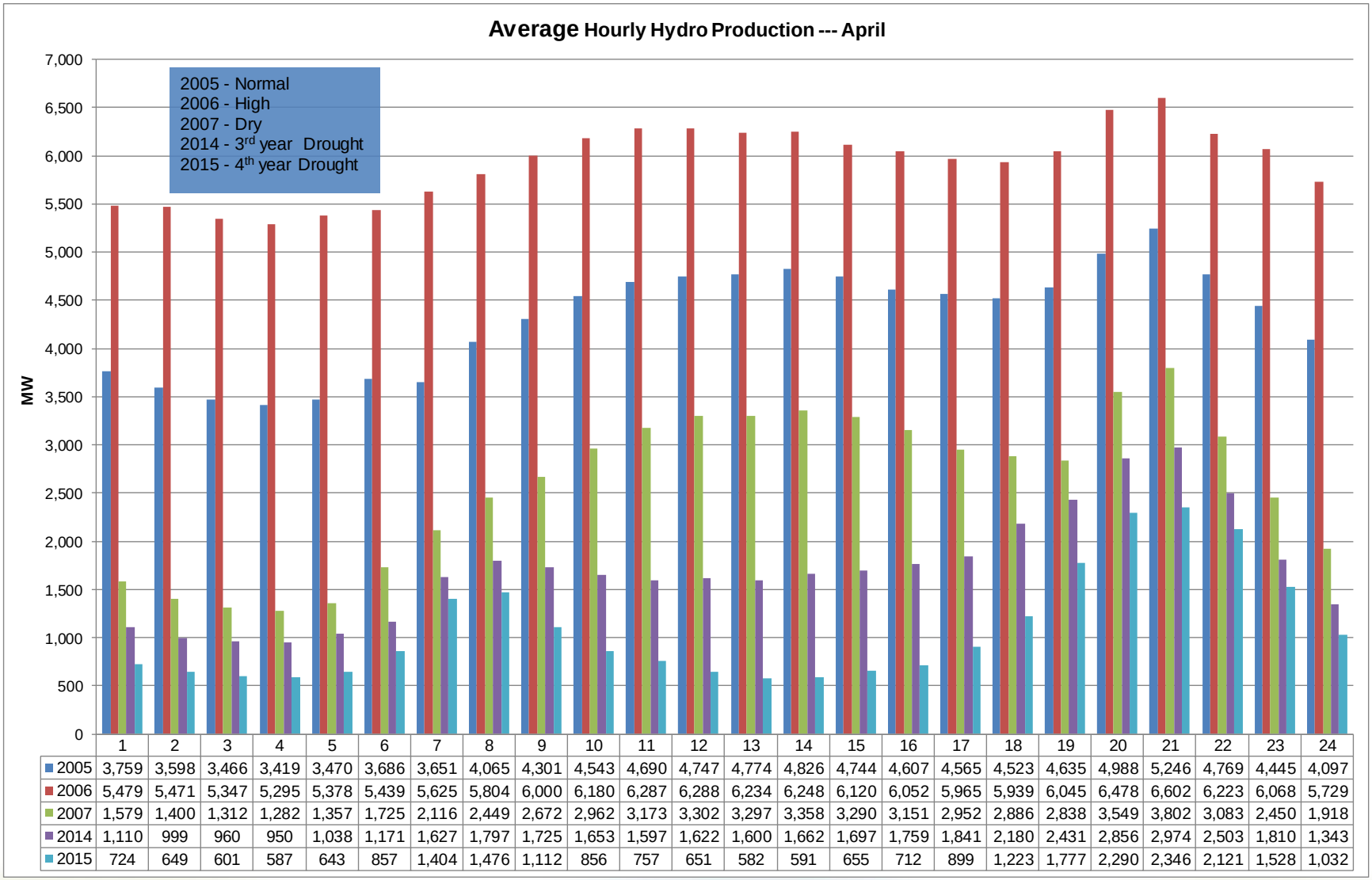
Over-generation is a problem for tomorrow, but planning should begin today

- Actual operational experience with over-generation has been limited to date
  - Solar output expected to increase
    - 6,000 MW transmission connected
    - 3,000 MW distributed
  - Low hydro conditions
    - Hydro output at record low levels

Minimum net-loads will continue to decrease over time

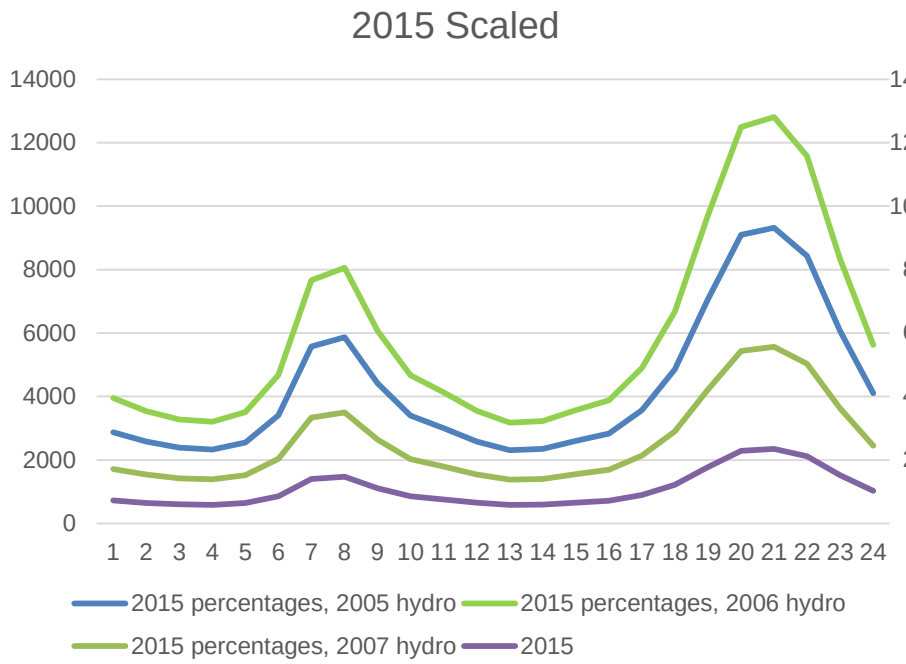


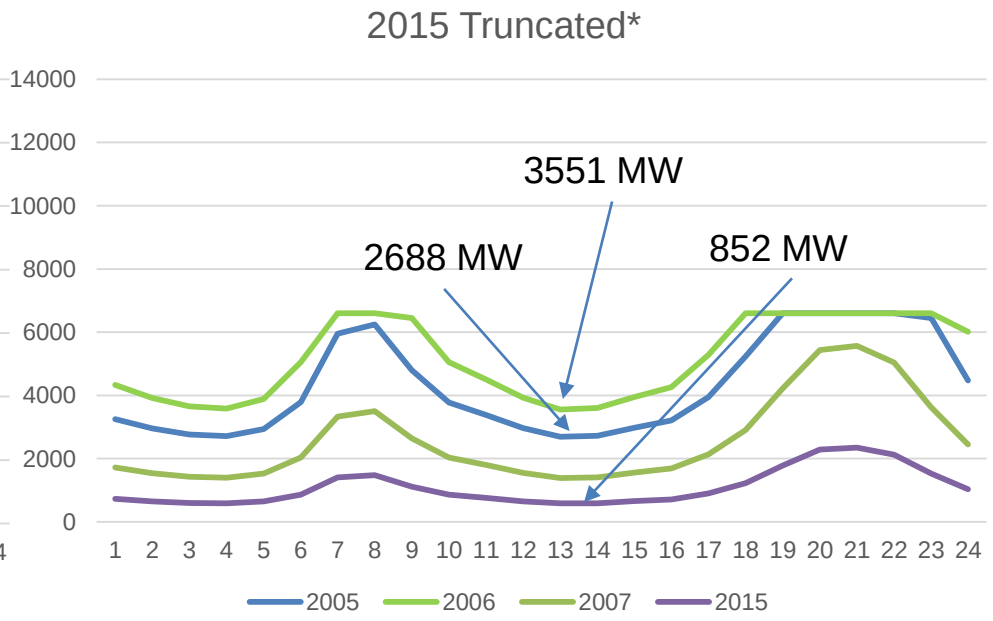
Average hourly hydro production for high, low and average hydro years --- April



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2005	3,759	3,598	3,466	3,419	3,470	3,686	3,651	4,065	4,301	4,543	4,690	4,747	4,774	4,826	4,744	4,607	4,565	4,523	4,635	4,988	5,246	4,769	4,445	4,097
2006	5,479	5,471	5,347	5,295	5,378	5,439	5,625	5,804	6,000	6,180	6,287	6,288	6,234	6,248	6,120	6,052	5,965	5,939	6,045	6,478	6,602	6,223	6,068	5,729
2007	1,579	1,400	1,312	1,282	1,357	1,725	2,116	2,449	2,672	2,962	3,173	3,302	3,297	3,358	3,290	3,151	2,952	2,886	2,838	3,549	3,802	3,083	2,450	1,918
2014	1,110	999	960	950	1,038	1,171	1,627	1,797	1,725	1,653	1,597	1,622	1,600	1,662	1,697	1,759	1,841	2,180	2,431	2,856	2,974	2,503	1,810	1,343
2015	724	649	601	587	643	857	1,404	1,476	1,112	856	757	651	582	591	655	712	899	1,223	1,777	2,290	2,346	2,121	1,528	1,032

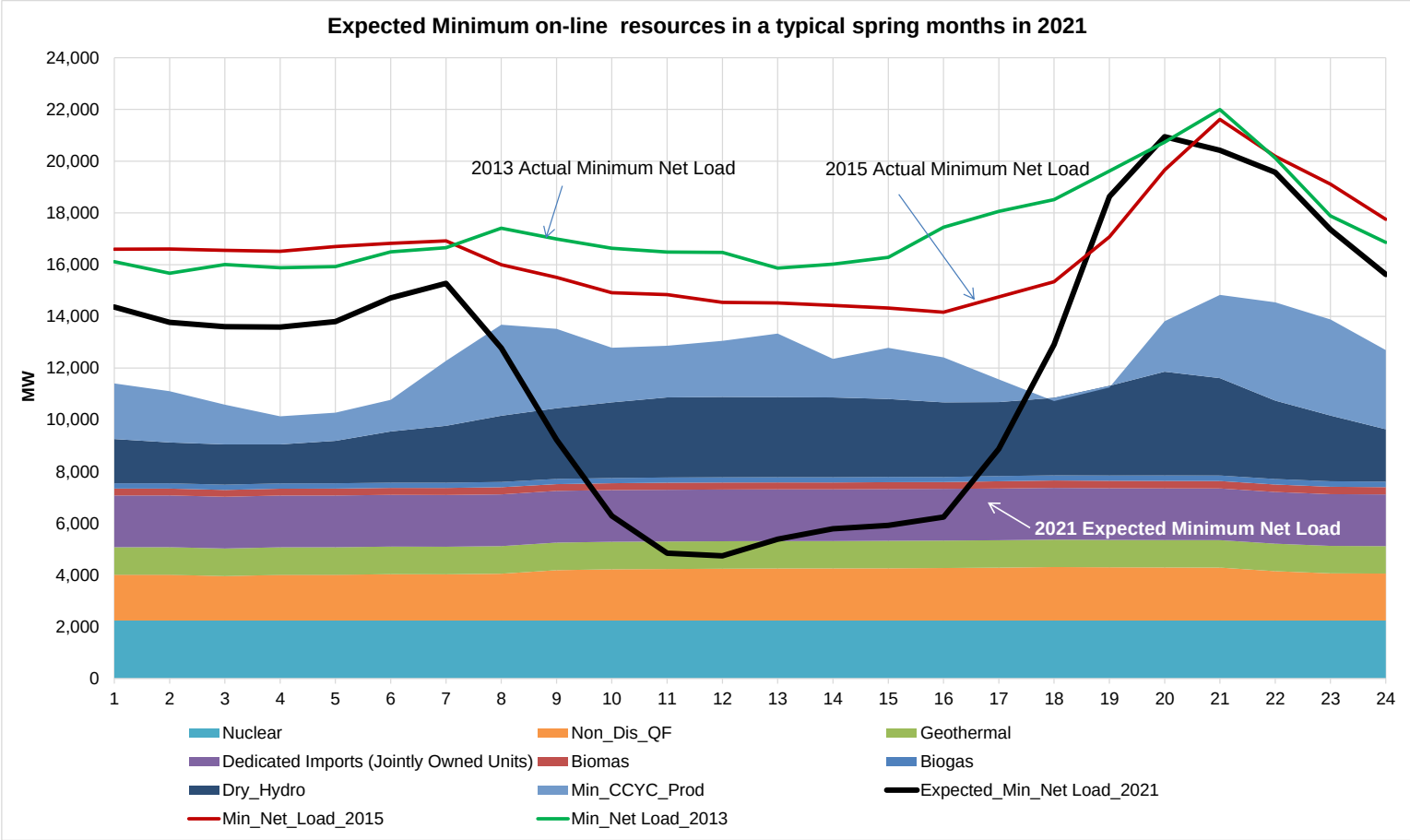
Net-load following hydro may still add 2,000-3,000 MW of additional hydro production through the mid-day under normal hydro conditions



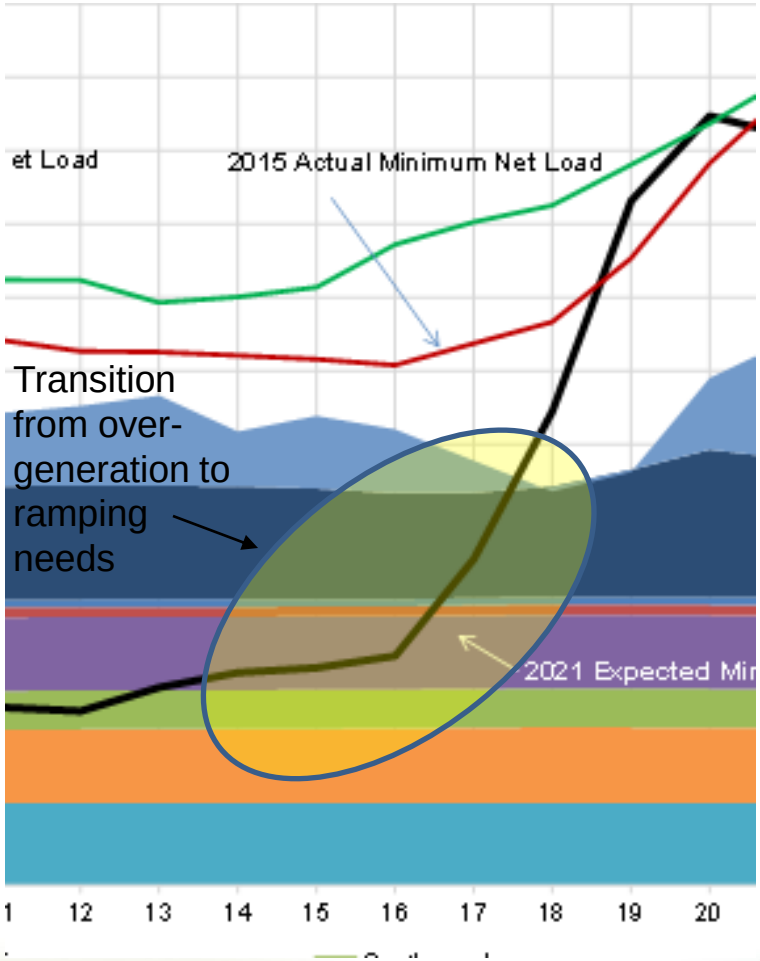


* Hydro output is truncated at the max out put for 2006. Any excess output is reallocated to other hours.

Over-generation is caused by inflexible capacity and imminent ramping needs

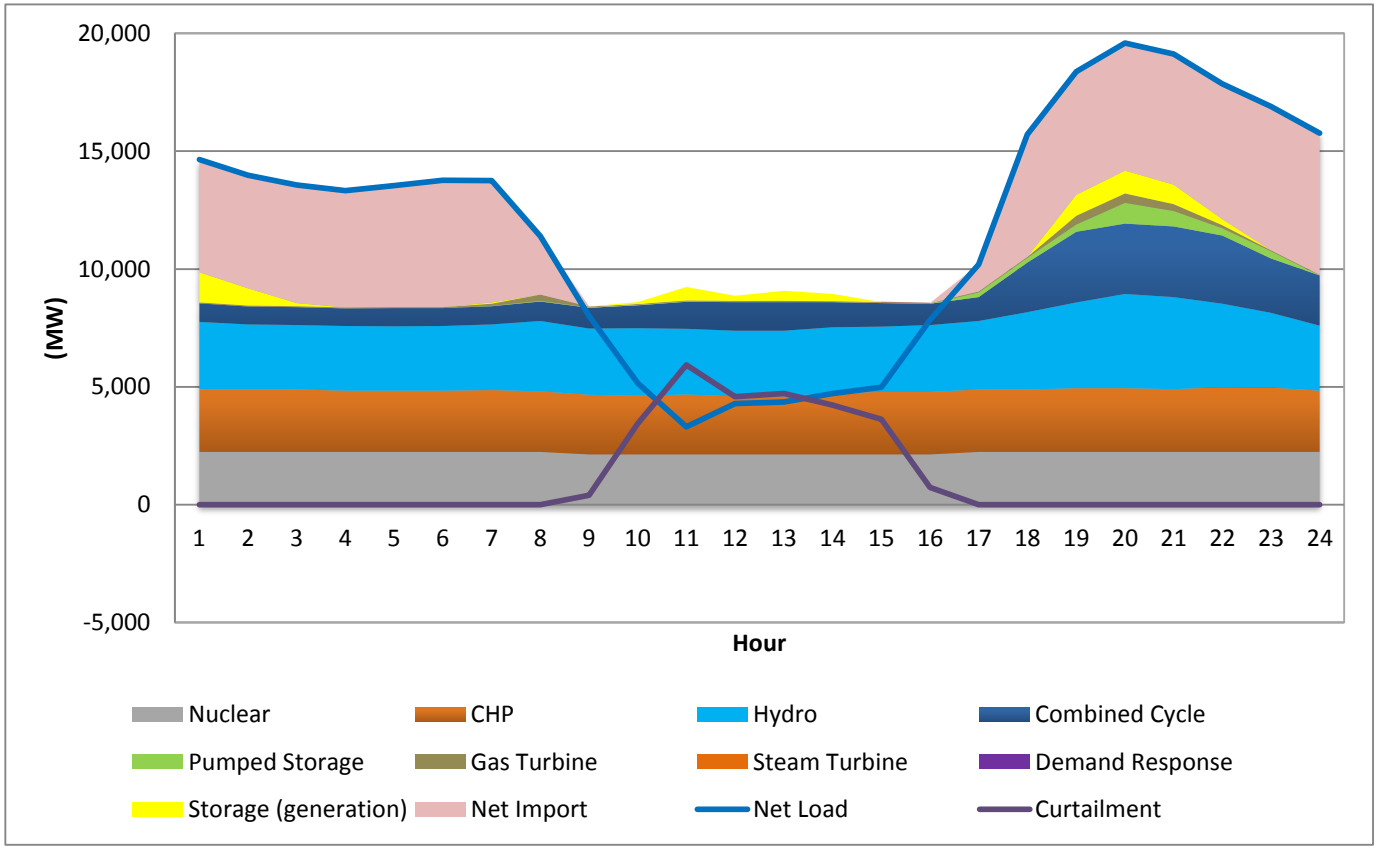


Rampable resources must be either on-line with low minimum loads or able to start quickly to address net load ramps



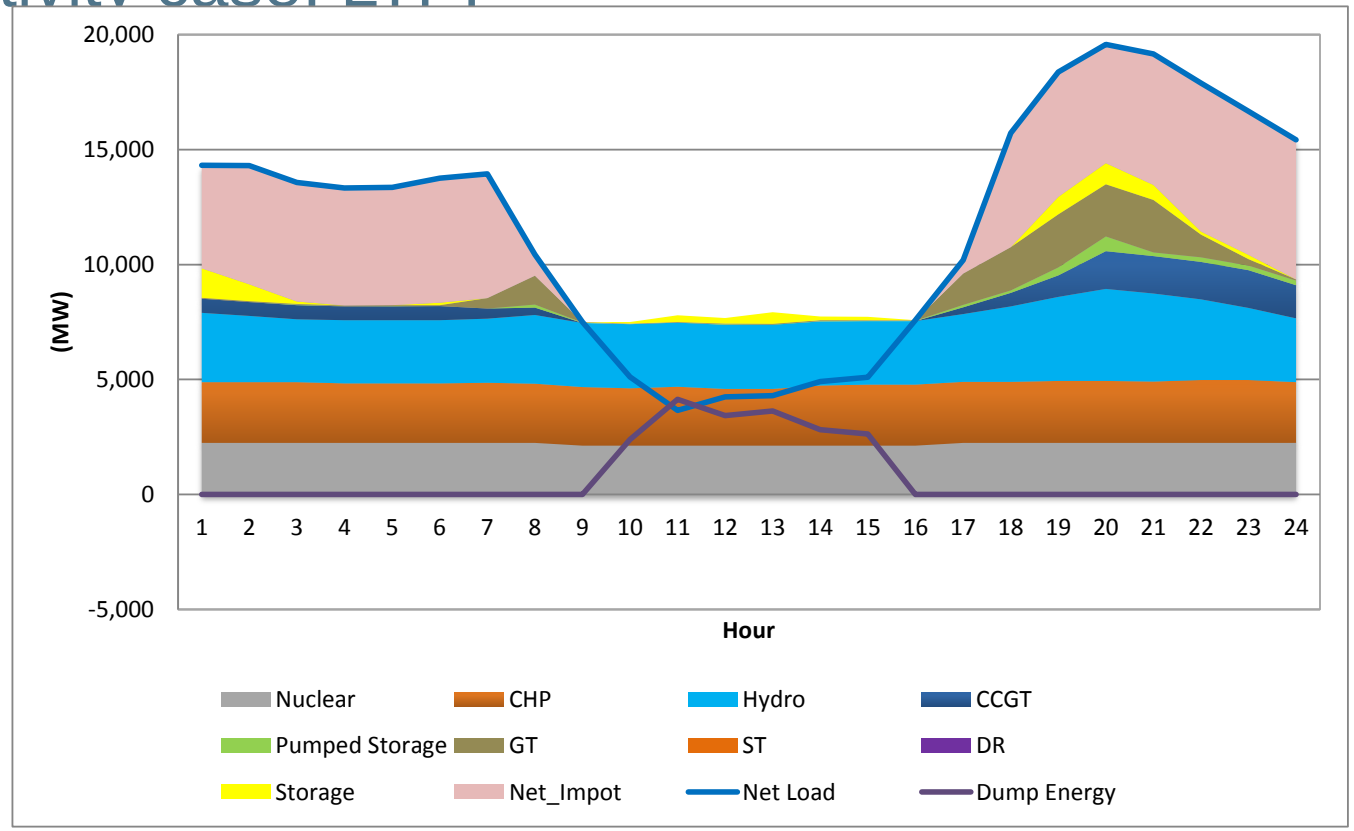
- ISO must have sufficient ramping capacity available to meet net load ramps
  - Fast start
  - Low Pmin

An example of over-generation: The ramping process of March 24, 2024 - Trajectory scenario, LTPP*



*Assumes a WECC wide dispatch. Realization of the dispatch requires full day-ahead and real-time market dispatch and zero forecast error

An example of over-generation: The ramping process of March 24, 2024 - Trajectory scenario no curtailment sensitivity case, LTPP*



*Assumes a WECC wide dispatch. Realization of the dispatch requires full day-ahead and real-time market dispatch and zero forecast error

Problem Statements

- ISO has tools to help mitigate over-generation
  - Does not ensure all excess supply can be reliably absorbed
- Forward planning is needed to ensure tools are available to the ISO to address excess supply
  - Primary focus – Managing the PMin burden and the interplay between quantities of inflexible capacity and ramping capability provided by RA resources, particularly in non-summer months
- Flexible capacity solutions identified in long-term planning should have an obligation to provide the capacity solutions for which they were procured
- Any modifications should ensure system, local, and flexible capacity needs are addressed

The ISO has or is developing tools that will help mitigate over-generation, but…

Existing tools or enhancements already underway

1. Flexible Ramping Product
2. EIM
3. Exceptional dispatch
4. Over-generation operating procedures

Future tools for day-ahead and real-time markets

1. Extend Unit Commitment Time horizon
2. Lower bid floor
3. Adjust penalty parameters for day-ahead and real-time bidding and self-scheduling

… Additional changes to forward planning are necessary compliments to these market features

Changes to the forward planning

1. Account for system upward and downward operational constraints
2. Allow 15-minute intertie resources to provide flexible RA
3. Split RA showings into separate inflexible and flexible capacity showings
4. Inflexible capacity RA “allowances”
5. Conduct secondary assessment of one-hour ramping capabilities

EXISTING TOOLS AND ENHANCEMENTS UNDERWAY

Flexible ramping product will help manage the fleet operationally, but cannot address over-generation

- Ensure there is sufficient flexible capacity to address five minute deviations
- Cannot provide downward flexibility if none is available (i.e. all resources are at Pmin)
  - Requires resources be on-line and operating above Pmin

EIM provides market benefits in real-time, but over-generation is limited by adjacent BAAs day-ahead dispatches

- EIM prohibits leaning for purposes of flexible capacity
  - Sufficiency test
- Adjacent BAAs will only take excess generation if:
  - Day-ahead dispatch and real-time need allow for it
  - Real-time price plus transmission charges to export exceed the cost of internal generation
- Greater benefits can be achieved with fully integrated IFM and RTM

The ISO may be forced to rely more heavily on exceptional dispatch and CPM to manage over-generation

- If the ISO is unable to ramp resources down low enough, it may have to exceptional dispatch resources off
- If a resource is exceptional dispatched off in the morning, it may not be available in the evening
- Because the ISO exceptionally dispatched a resource off in the morning, it may have to exceptionally dispatch (or CPM) another resource on for an evening ramp

- The ISO considers increased reliance on Exceptional Dispatch as an unacceptable solution

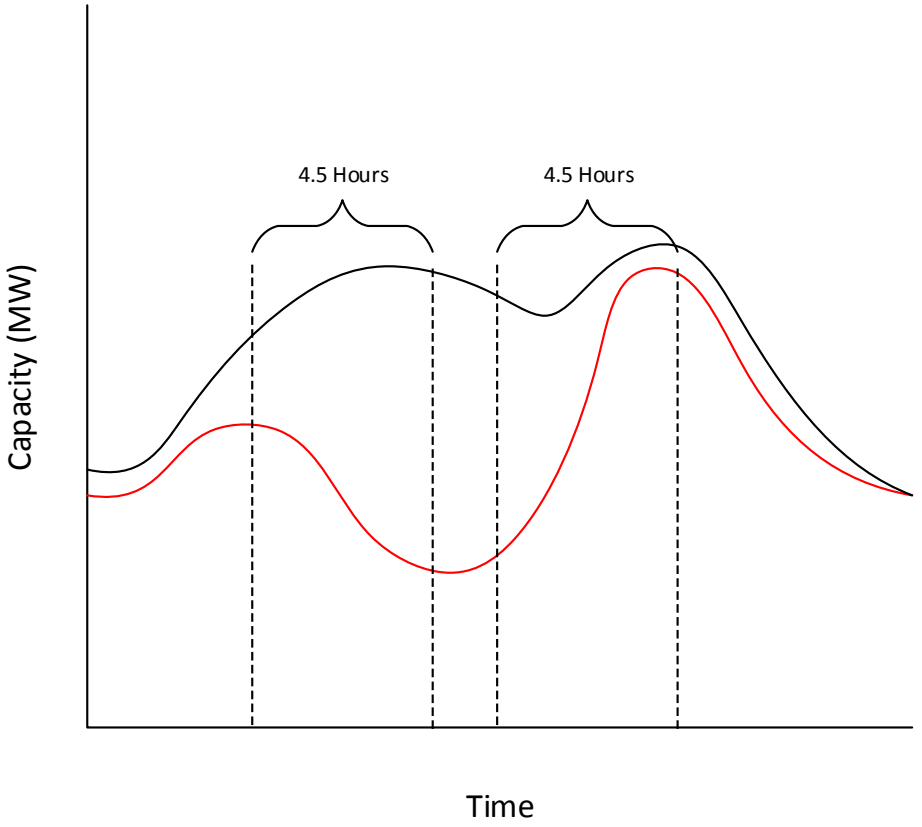
Over-generation operating procedures should not be relied on as a daily solution to over-generation

- Over-generation procedures were designed to supplement the DAM and RTM dispatches, not replace them
- It is not feasible, reasonable, or responsible to rely on these procedures on a daily, or even frequent, basis

POTENTIAL NEW ENHANCEMENTS

The ISO's short-term unit commitment processes must be able to see past the "belly of the duck"

- Current STUC outlook looks out 4.5 hours
- May determine optimal solution is to decommit a resource
- Once decommitted, the resource may be gone for evening ramp
- ISO may expand unit commitment horizon beyond 4.5 hours to see past the belly of the duck



Lowering the bid floor better reflects costs of inflexibility and incentivizes flexible bidding and operation

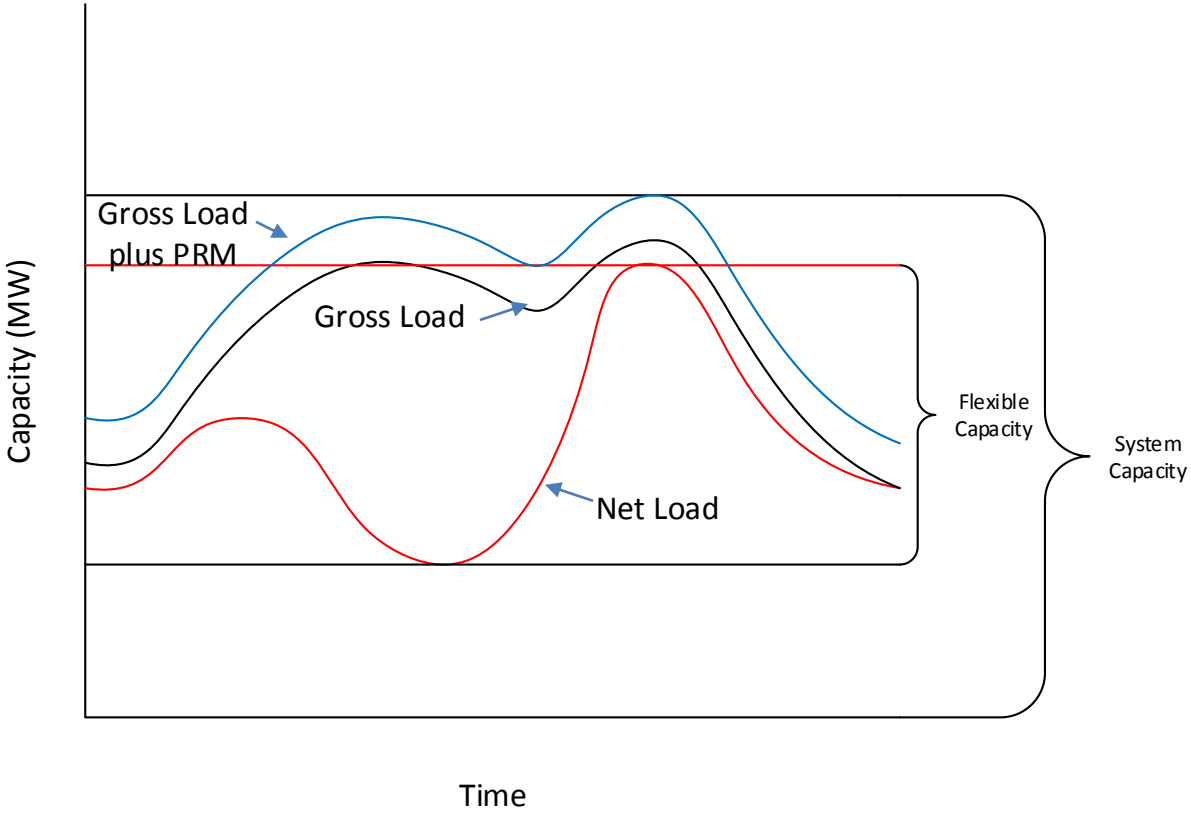
- Current bid floor of -$150 is not sufficient to
  - Incentivize economic bidding
  - Accurately reflect the costs inflexible capacity may cause during over-generation conditions
- Lower bid floors should
  - Increase the incentive to economically bid
  - Incentivize investments in existing capacity to reduce quantities of inflexible capacity
- Over-generation can lead to reliability challenges that should be reflected in the bid floor the same way it is captured in the bid ceiling

The ISO is considering a priority ranking for self-scheduled resources to help manage over-generation

- Self schedules are protected at lower prices in the ISO's scheduling run (-$1100 vs -$150 for economic bids)
- There is no distinction made between RA and non-RA resources
- RA resources should receive a higher level of protection than non-RA
  - The ISO relies on RA to reliably operate the system and should only curtail these resources if necessary
- The penalty parameter non-RA self-schedules should be set at or just below (more negative) the bid floor

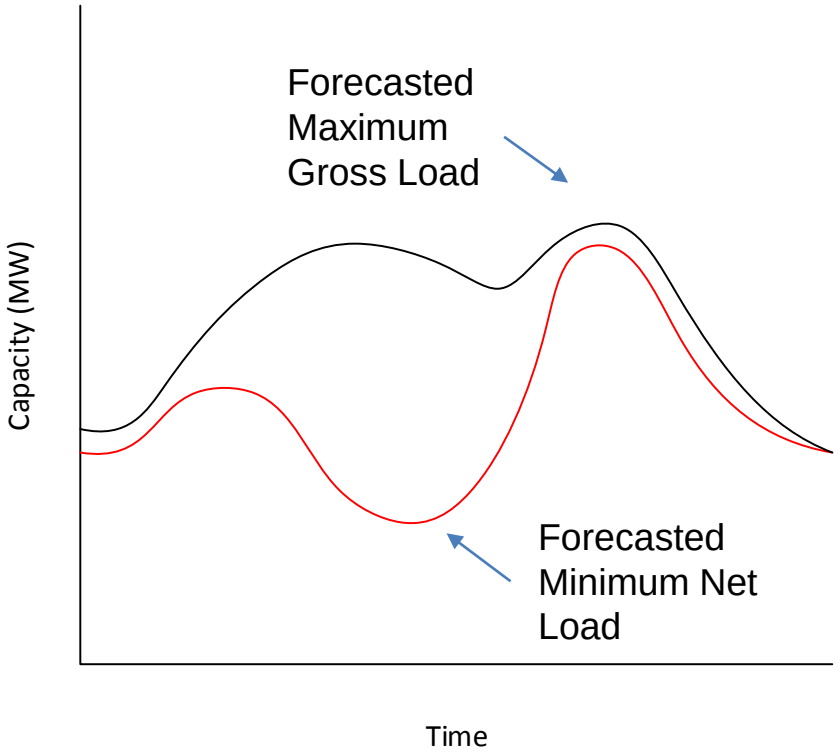
CAPACITY REQUIREMENTS: INFLEXIBLE CAPACITY, FLEXIBLE CAPACITY, AND ALLOWANCES

The current flexible capacity requirements



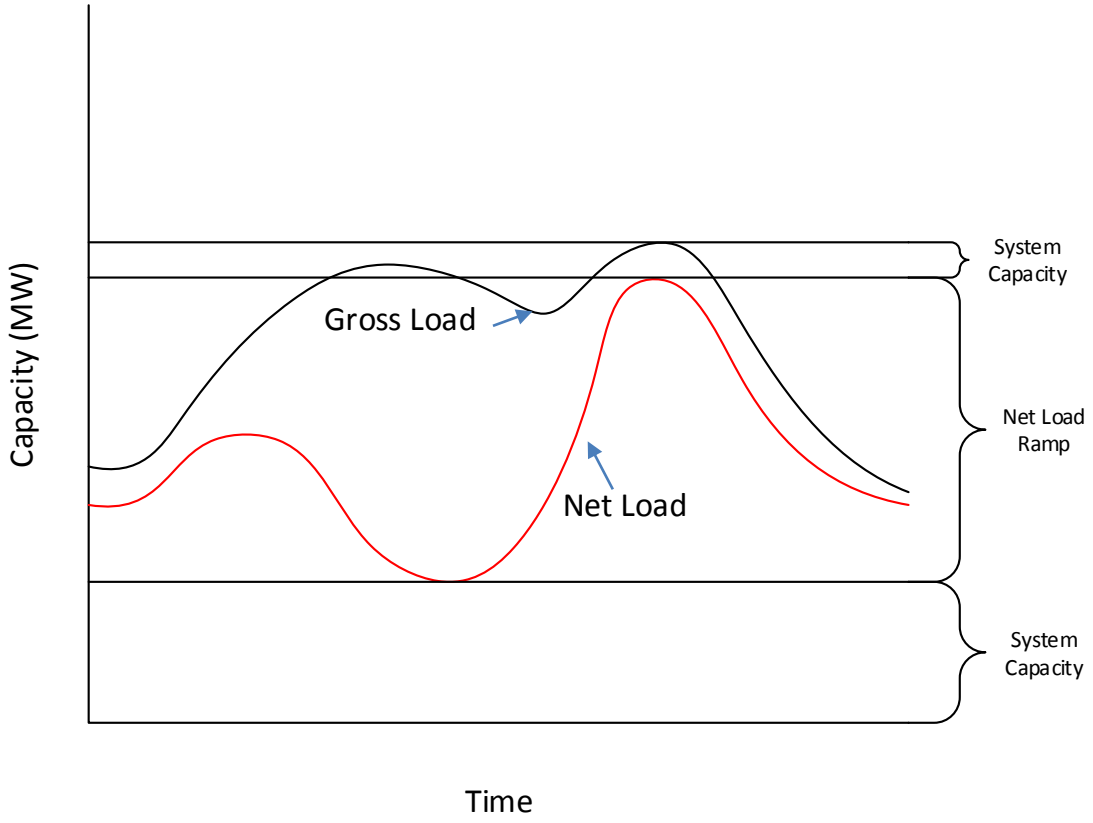
The core principle behind flexible capacity is a must-offer obligation that requires economic bids

Need to rethink flexible vs. inflexible capacity while focusing on the core principles of economic bidding, and operational and environmental objectives



- Applied only in months when over-generation is a concern
- Develop forecasted load and net load curves
- Identify minimum forecasted net load in a month
- Identify forecasted monthly maximum gross load in a month
- Determine forecasted planning reserve margins

Need to rethink flexible vs. inflexible capacity while focusing on the core principles of economic bidding, and operational and environmental objectives (cont.)

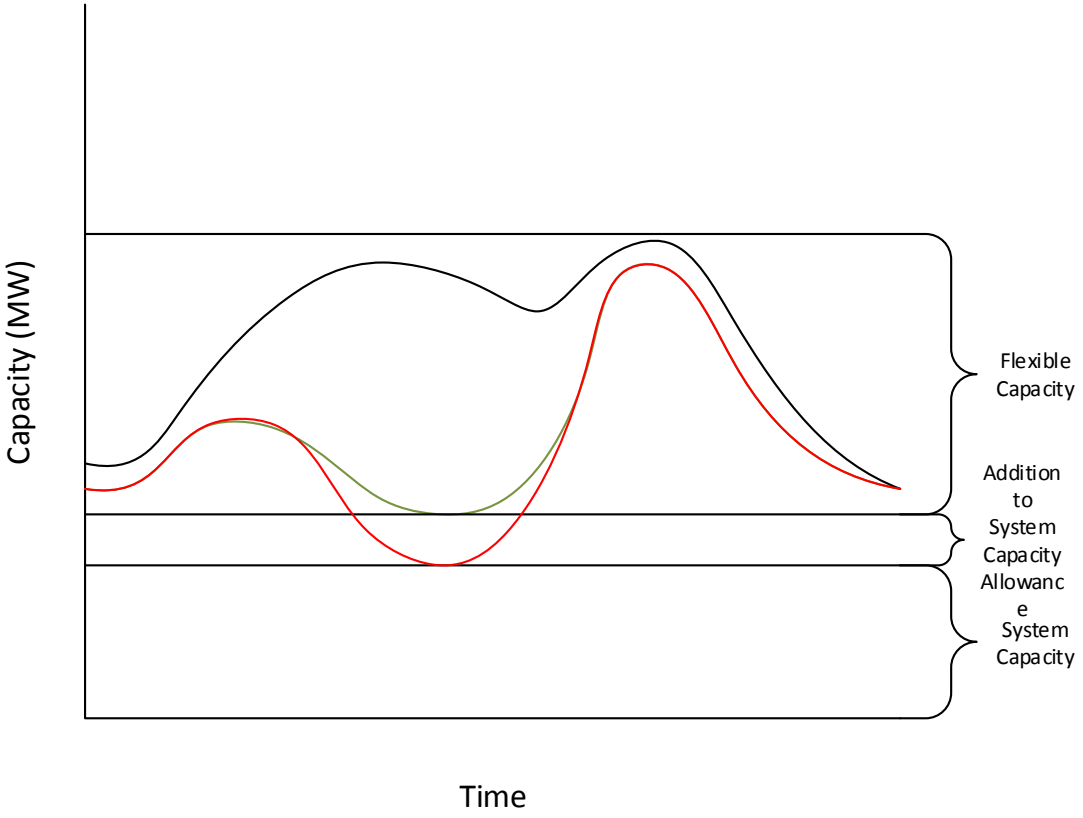


- Inflexible capacity set at minimum forecasted net load plus forecasted VER output at peak
- Net load curve variations within or across months may require adjustments to develop systemic method for determining inflexible capacity limits
- Flexible capacity requirement covers the remainder of the capacity needs

Inflexible capacity allowances would allow LSEs to meet inflexible capacity constraints at least cost

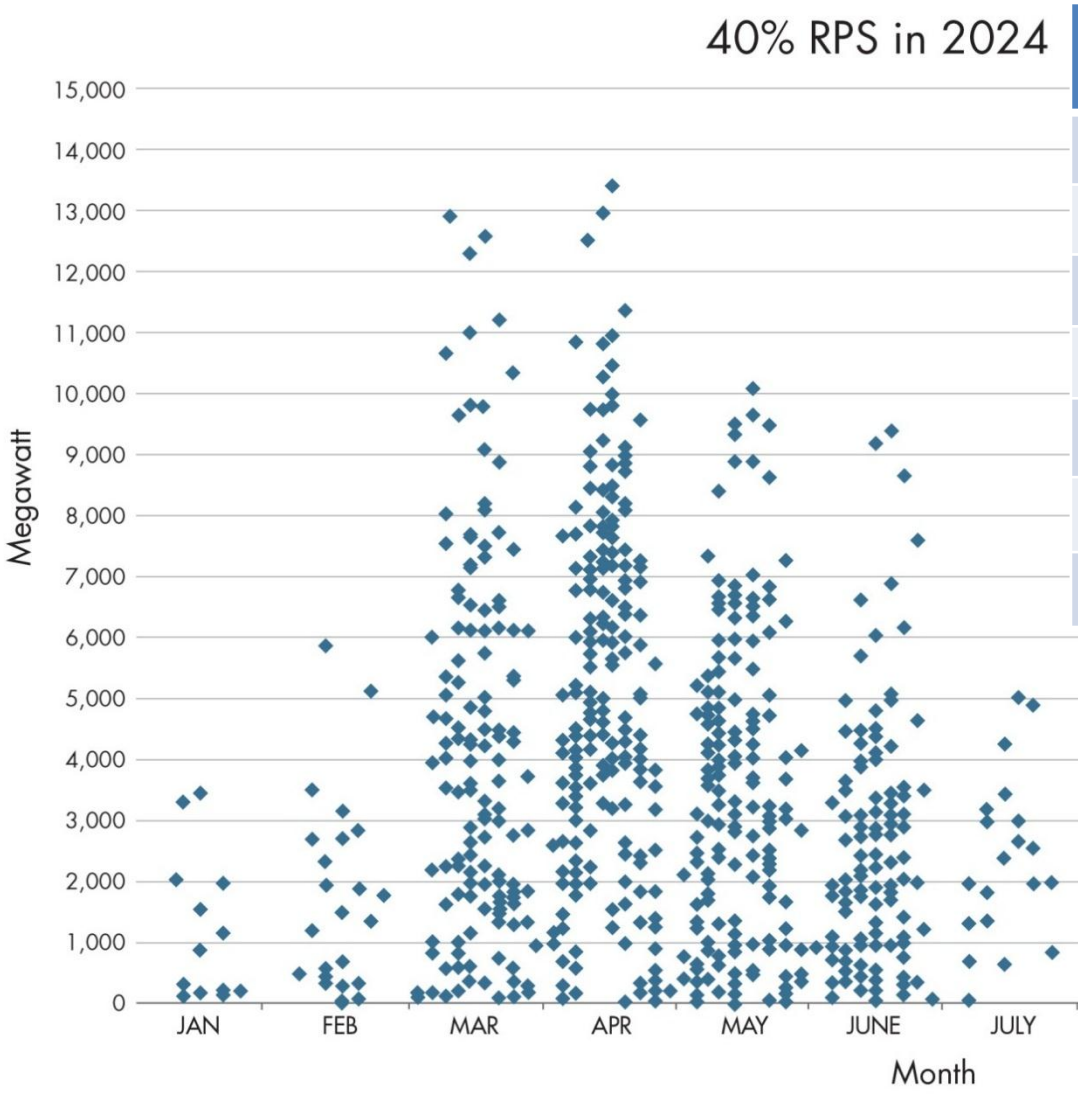
- Large quantities of inflexible capacity increase the probability of over-generation
- There is currently a significant amount of inflexible capacity existing in the ISO
  - Inflexible QF
  - Nuclear
  - Run-of-river hydro
  - Self scheduled resources
- Inflexible capacity allowances are a means of increasing allowable inflexible capacity at the lowest cost
  - Allowances do to not help address gross load and are not RA capacity
  - Value should reflect incremental benefit of downward flexibility (i.e. same as incentive to lower Pmin of a resource)

Allowable inflexible capacity can be increased by providing allowances



- Allowances for inflexible capacity for:
  - Dispatchable load
  - Dispatchable wind and solar
  - Storage load
  - Exports
- <u>All allowances must be bid into the ISO markets</u>
  - Event based triggers will not count towards the credits
- Note for energy storage:
  - Discharge would be RA
  - Charging would be an allowance

Over-generation requires a multi-dimensional solution



Mitigations
Retrofit existing power plants
Enable economic dispatch of renewables
Decarbonize transportation fuels
Increase storage and demand response
Align time-of-use rates with system conditions
Deeper Regional Coordination (EIM)
Targeted Energy Efficiency

A flexible capacity program with allowances can incorporate all of the ISO's suggested mitigations

- Retrofit existing power plants: Provides an incentive to reduce PMin on existing plants
- Economic dispatches of renewables: Dispatchable renewables can be used as an allowance
- Decarbonize transportation fuels: Captured in IEPR forecast or shown as an allowance
- Increase storage and demand response: Captures the value of output during peak for RA and can be shown as an allowance
- Time of use rates: Captured in IEPR forecast
- Deeper regional coordination: Imports and exports can be used to provide flexible capacity
- Targeted energy efficiency: Captured in the IEPR forecast

An allowance system based on economic must-offer obligations can provide a durable solution to over-generation concerns

- Ensures “allowance” resources provide economic bids (i.e. MOO) for over-generation mitigation (i.e. a means to absorb excess supply)
  - Does not mean resources will be utilized in all hours
- Allowances can be provided by resources that change net load
- The allowance is a variation of “unbundling” NQC and EFC
  - Allowances calculated based on resource parameters
  - Requires MOO that focuses on over-generation hours
- Need for allowances are a function of an LSE RA portfolio
  - Inflexible capacity resources need not procure allowances
  - Resources shown as an allowance would provide a supply plan consistent with the allowance

Meeting inflexible capacity allocation and the need for allowances

- Determine LRA contribution to minimum net load
  - Contributing resources may include any RPS-eligible output (i.e. biogas, biogas, geothermal, solar, wind, etc.)
- If LSE's procurement exceeds inflexible capacity allocation, allowances can fill in the gap
- Allowances can be provided by resources that change net load and may already be under contract (i.e. zero additional costs)
  - Contracts for dispatchable VERs
  - Storage

Example

- LSE1 has an RA requirement of 1000MW
  - Inflexible capacity cap of 400 MW
  - Under contract
    - 450 MW QF
    - 25 MW solar (NQC value 5 MW)
    - 25 MW storage
    - 550 MW gas turbine (start-up time = 60 min)
- Showing
  - Inflexible: 450 MW QF
  - Flexible: 550 MW gas turbine
  - Allowances: 25 MW storage, 25 MW dispatchable solar

An example of how an LSE could use inflexible capacity allowances to meet RA requirements

RA showing* (without an allowance)

- Total requirement = 1000 MW
- Max inflexible RA: 400 MW
- Min flexible RA: 600 MW
- Showing
  - Max inflexible RA: 400 MW
  - Min flexible RA: 600 MW
- Total RA and allowance capacity shown: 1000 MW
- Total RA capacity shown: 1000 MW

RA showing* (with an allowance)

- Total requirement = 1000 MW
- Max inflexible RA: 400 MW
- Min flexible RA: 600 MW
- Showing
  - Inflexible RA: 450 MW
  - Flex RA: 550 MW
  - Inflexible capacity allowance: 50 MW
- Total RA and allowance capacity shown: 1050 MW
- Total RA capacity shown: 1000 MW

* Assumes the ISO validates showings of flexible and in flexible using a summation method

An example of how an LSE could use inflexible capacity allowances to meet RA requirements (cont.)

Incorrect RA showing* (without an allowance)

- Total requirement = 1000 MW
- Max inflexible RA: 400 MW
- Min flexible RA: 600 MW
- Showing
  - Max inflexible RA: 450 MW
  - Min flexible RA: 550 MW
- Total RA and allowance capacity shown: 1000 MW
- Total RA capacity shown: 1000 MW

Incorrect RA showing* (with an allowance)

- Total requirement = 1000 MW
- Max inflexible RA: 400 MW
- Min flexible RA: 600 MW
- Showing
  - Max inflexible RA: 450 MW
  - Min flexible RA: 500 MW
  - Inflexible capacity allowance: 50 MW
- Total RA and allowance capacity shown: 1000 MW
- Total RA capacity shown: 950 MW

* Assumes the ISO validates showings of flexible and in flexible using a summation method

Next Steps

- Comments on working group proposal
  - Due September 1, 2015
  - Submit comments to InitiativeComments@caiso.com
- Final working group meeting September 30, 2015